2013-1641, -1642, -1643, -1644

UNITED STATES COURT OF APPEALS FOR THE FEDERAL CIRCUIT

AMERICAN RADIO LLC,

Plaintiff-Appellant,

v.

QUALCOMM INCORPORATED,

Defendant-Appellee,

and

CISCO SYSTEMS, INC.,

Defendant-Appellee,

and

INTEL CORPORATION,

Defendant-Appellee,

and

BROADCOM CORPORATION,

Defendant-Appellee.

Appeals from the United States District Court for the Central District of California in case nos. 12-CV-5908, 12-CV-5909, 12-CV-5910, and 12-CV-1123, Senior Judge Mariana R. Pfaelzer.

BRIEF FOR DEFENDANTS-APPELLEES QUALCOMM INCORPORATED, CISCO SYSTEMS, INC., INTEL CORPORATION, AND BROADCOM CORPORATION

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   None.

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3. All parent corporations and any publicly held companies that own 10 percent or more of the stock of the party or amicus curiae represented by me are:

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STATEMENT OF RELATED CASES

There are no related cases pending before this Court other than the four cases that have already been consolidated in the present appeal: (1) *American Radio LLC v. Qualcomm Incorporated*, Appeal No. 2013-1641; (2) *American Radio LLC v. Cisco Systems, Inc.*, Appeal No. 2013-1642; (3) *American Radio LLC v. Intel Corporation*, Appeal No. 2013-1643; and (4) *American Radio LLC v. Broadcom Corporation*, Appeal No. 2013-1644. No appeal in these cases was previously before this or any other appellate court.

Counsel for Defendants-Appellees Qualcomm Incorporated ("Qualcomm"), Cisco Systems, Inc. ("Cisco"), Intel Corporation ("Intel"), and Broadcom Corporation ("Broadcom") (collectively, "Appellees") are unaware of any other case pending in this or any other court that will directly affect or be directly affected by the Court's decision in this appeal.

INTRODUCTION

The district court properly rejected American Radio's proposed constructions and construed the disputed terms based on their use in the claims, the specification, and their plain meaning in the art. The claims, as construed, encompass the scope of the claimed invention described by the patents, i.e., a system that receives an analog radio frequency ("RF") signal at a carrier frequency, digitizes that signal, and then performs "reconstruction" on the digitized

signal. "Reconstruction" has no ordinary meaning in the art, but the common specification for the patents-in-suit uniformly describes "reconstruction" as replacing distorted portions of the digitized signal with undistorted portions one wave or cycle at a time.

None of Appellees' products practices the claimed invention as properly construed. Thus, American Radio stipulated to judgments of non-infringement. American Radio now asks this Court to reject the district court's claim constructions by ignoring the claims, specification, and purpose of the alleged invention, contrary to the core tenets of claim construction. In particular, American Radio seeks a construction of the "analog signal" and "digitized signal" terms that would encompass signals at ***any*** frequency, notwithstanding the clear claim language and the specification's teachings that the purported invention requires digitizing RF signals ***at the carrier frequency***, prior to any mixing or demodulation, because "the mixing function causes certain data in the signal to be irrecoverable and therefore precludes identification of some distortion and corruption in the 'true' signal post-mixing." A157(1:60-63).[1] American Radio further contends that the term "IF" should be construed so that the claims encompass "direct conversion" receivers that downconvert an RF signal before digitizing, even though such an interpretation is contrary to every disclosure in the

[1] All citations to the common specification of the asserted patents refer to U.S. Patent No. 5,864,754 ("the '754 patent").

specification. And finally, American Radio asks the Court to construe "reconstruction" in a way calculated to include techniques for addressing signal distortion that the patentee distinguished, as well as operations on extracted data that the district court correctly held "fall[] entirely outside the scope of the teachings of the asserted patents." A30-31.

The district court's constructions are supported by the claim language, the specification, and the plain meaning of the terms based on intrinsic and extrinsic references. American Radio's attempt to revive its case by seeking constructions outside the scope of, and in conflict with, the teachings of the asserted patents should be rejected and the non-infringement judgments should be affirmed.

STATEMENT OF ISSUES

1. Whether the district court correctly construed the "analog signal" terms to mean "the [analog rf / rf / analog sinusoidal / electromagnetic] waveform at the carrier frequency."

2. Whether the district court correctly construed the "digitized signal" terms to mean "the digitized form of the received [rf / analog sinusoidal / amplified electromagnetic] signals."

3. Whether the district court correctly construed "IF" to mean "a frequency to which the input signal is shifted, including shifting the signal to zero Hertz."

4. Whether the district court correctly construed the "reconstruction" terms to mean "replacing a distorted portion of the input waveform at the carrier frequency with an undistorted portion, wherein the operand of the reconstruction operation represents one full wave or cycle."

STATEMENT OF CASE AND FACTS

American Radio brought the four underlying suits against Appellees Broadcom, Qualcomm, Cisco, and Intel in the Central District of California in July 2012. A213; A1245; A2298; A3407. American Radio alleges that Appellees infringe various claims of U.S. Patent Nos. 5,864,754 ("the '754 patent"), 7,831,233 ("the '233 patent"), 8,045,942 ("the '942 patent"), 8,170,519 ("the '519 patent"), and 8,280,334 ("the '334 patent"). A1094-101; A2129-35; A3218-25; A4301-10.

A. The Parties

Appellees are among the world's leading developers of signal processing technologies. They design, develop, and sell a variety of products for the computing, broadband, and telecommunications industries. For example, Intel and Qualcomm design and sell semiconductor chips that allow cellular phones and other mobile devices to communicate over cellular networks; Broadcom designs and sells cable modem chips; and Cisco sells cable routers that use Broadcom's cable modem chips.

American Radio purports to own the patents-in-suit. A1095; A2130; A3219; A4302. It does not make any products that practice any claim of the patents-in-suit. A6266(38:7-13). American Radio has unsuccessfully attempted to license the patents-in-suit. A6265-66(37:22-38:6).

B. RF Communications

Many communication systems, such as cellular phone and cable systems, transmit information using radio frequency ("RF") waves. A6204. In most modern systems, the information being conveyed, which could be a person's voice, a text message, or a television program, is first put into digital form (i.e., a string of 1s and 0s) constituting the data to be transmitted. This digital data is then converted to an analog signal called a "baseband signal" in preparation for transmission. A6205.

Baseband signals are at such a low frequency that they cannot be transmitted directly over the air or cable (or other media). Instead, the baseband signal must be imprinted onto a high frequency analog wave called a "carrier" wave, through a process known as "modulation." As the name implies, the carrier wave is used to "carry" the baseband signal. A modulated carrier wave is generally referred to in the art as an "RF signal." A6206.

The RF signal is transmitted from a transmitter to a receiver. After the RF signal is received at the receiver's antenna, a "mixer" may be used to reduce the

frequency of the modulated carrier wave through a process called "downconversion." A6211. Once the RF signal is mixed (or downconverted), it is referred to as an "intermediate frequency" or "IF" signal. A6211. Receivers that mix the RF signal from the carrier frequency to a low or zero Hertz frequency in two or more stages are referred to as "superheterodyne" receivers. A6219. Receivers that downconvert an RF signal from the carrier frequency directly to a low or zero Hertz frequency in a single stage are referred to as "homodyne," "zero-IF," or "direct conversion" receivers. A6218-19. When an RF signal is downconverted from the carrier frequency to a low or zero Hertz frequency, the resulting signal is at baseband. A6205-08. This is sometimes referred to as "zero Hertz" because the frequency of the carrier wave has been reduced to zero. A6205-08; A6211.

Once any analog processing is complete, an analog-to-digital converter ("ADC") then digitizes the signal. A6212.[2] After the signal has been digitized, it may be further processed by a digital signal processor ("DSP"), a circuit that can

[2] An ADC digitizes an analog signal by sampling its voltage at regular intervals and converting those voltages to digital values. One of the reasons that receivers typically downconvert an RF signal prior to digitization is because it is easier to perform the sampling operation on a lower frequency signal. A6212-13.

perform a wide and flexible range of functions using stored programs. A6213.[3] Finally, the receiver demodulates the signal, recovering the baseband signal and ultimately the transmitted data. A6207-09.

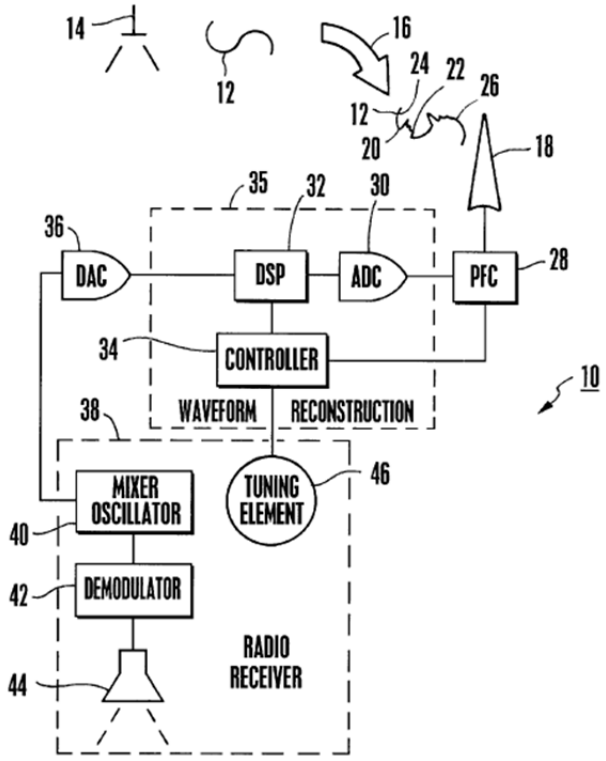
C. The Patents-In-Suit

The patents-in-suit, which stem from the same application and share a common specification, describe an apparatus that receives a high frequency carrier waveform, digitizes it, and then performs a method the patents call "reconstruction" to replace portions of the waveform that were distorted during transmission. A153(abstract); A157(1:5-9). Specifically, the "invention is directed to removing distortions from rf signals, prior to mixing and demodulating the signals incident to the decoding of useful information therefrom." A158(4:15-19).

[3] Many types of processing may be performed in either the analog or the digital domain. For example, a receiver may use both analog and digital filtering to block unwanted signals and isolate the signal of interest. A6210.

1. The specification

Figure 1 depicts "the system of the present invention" (A158(3:61-62)):



A154. An RF transmitter 14 transmits an "rf signal" 12, which is an "analog, sinusoidally-shaped signal" at the carrier frequency. A158(4:3-9); *see* A4; AR Br. 8-10. Although the signal starts out "relatively smooth and undistorted," it may become "degraded and distorted" during transmission due to noise, interference, and environmental factors. A157(1:20-22); A158(4:6-11); *see also* A154 (depicting "rf signal" 12 with distorted portions 22 and undistorted portions 24).

The receiver's antenna receives the distorted RF signal and sends it to a preamplifier filter circuit 28 to be amplified and filtered, prior to any mixing. A158(3:40-43, 4:11-13, 4:29-36). The analog RF signal is then converted into

digital form by an analog-to-digital converter ("ADC") 30. A158(4:40-45). Once in digital form, the RF signal can be "reconstructed" by a digital signal processor ("DSP") 32. A158(4:46-47, 4:55-56).

The specification notes that prior-art receivers "attempt[ed] to correct for signal corruption by suppressing corruption-induced noise using filtering techniques," which could be implemented "using analog or digital techniques." A157(1:22-27). The specification criticizes these prior-art structures because "although filtering improves the ratio between useful signal and noise (referred to as the signal-to-noise ratio, SNR), it typically reduces system fidelity and signal strength." A157(1:27-31). In light of this alleged prior-art problem, the specification discloses an alternative way to "remov[e] distortions from rf signals" that it terms "reconstruction." A158(4:15-19).

The specification explains that "reconstruction" must be performed on the RF signal itself—i.e., before mixing the signal from the radio frequency ("RF") to an intermediate frequency ("IF"). A158(4:15-19); *see* A154 (showing mixing performed by mixer 40). This is because "the mixing function causes certain data in the signal to be irrecoverable and therefore precludes identification of some distortion and corruption in the 'true' signal." A157(1:60-63). As a result, the specification explains not only that it is "advantageous" to perform "reconstruction" prior to mixing (A157(1:55-57)), but that it is an "object of the

present invention to provide a system and method for reconstructing a radio signal prior to mixing and demodulating the signal." A157(2:1-3); *see also* A158(3:58-65, 4:15-19); A154-55(Figs. 1-2).

To perform "reconstruction," the DSP analyzes the digitized RF signal one cycle at a time. A160(7:38-45); A156(Fig. 3). To "realize[]" "the advantages of the … invention," the DSP "remov[es] at least some of the distorted portions of [the] received waveform and ***replac[es]*** each distorted portion with a respective replacement portion." A159(5:59-65); *see also* A160(7:35-37, 7:56-59, 7:60-63).[4]

The specification explains that the replacement section may be taken from the opposite half-cycle of the RF waveform. A157(2:37-46); A160(7:13-47); A156(Fig. 3). Each waveform cycle has a positive half-cycle and a negative half-cycle:

Fig. 1 (excerpt)

A154 (annotations in red added). The patent proposes to "analyze both … halves of [the] rf signal cycle and determine which half is the 'best' half." A157(1:51-55). If the negative half-cycle is the "best" half, it is used in place of the distorted

[4] Except as otherwise noted, all emphasis in this brief is added.

positive half-cycle, thus "reconstructing" that cycle of the RF signal. A160(7:35-37); A156(Fig. 3).

The specification also states that "reconstruction" may be performed using prior-art Fast Fourier Transform ("FFT") and wavelet techniques to analyze and replace distorted portions of the signal with waveforms from a waveform library. A160(7:48-57, 7:61-67). According to the patent, when applying FFT the receiver "reconstruct[s] a smooth waveform from a distorted waveform by replacing the distorted input waveform with a series of smooth regular waveforms from a waveform library, with each replacement waveform having a unique frequency and an amplitude based upon its relative contribution to the reconstructed waveform." A160(7:50-56). The patent teaches that applying wavelet analysis is similar, such that "small undistorted waveform segments are stored in a library and are fitted to the undistorted portions of the input waveform as needed to replace distorted portions." A160(7:64-67).

Once the DSP has finished replacing distorted portions in the last cycle of the RF waveform, "reconstruction" is complete. A159(5:6-9). The reconstructed RF signal can then be mixed—i.e., downconverted to a lower-frequency signal. This can be done either by digital mixing in the DSP (A159(5:29-32)), or by converting the reconstructed signal back into analog form in a digital-to-analog converter ("DAC") and then mixing the signal using an analog mixer. A159(5:6-9,

5:12-15); A154(block 40). In either case, information is extracted from the reconstructed signal by a demodulator. A159(5:15-18); A154(block 42). As the specification repeatedly notes, neither mixing nor demodulation occurs until after the "reconstruction" process is complete. *See, e.g.*, A154-59(1:54-55, 3:21-23, 4:14-19, Fig. 1 (blocks 35, 40, 41), Fig. 2(blocks 56, 60, 64)). The specification does not describe or otherwise address any operations performed on the extracted data.

2. The asserted claims

American Radio asserted claims 1-3 of the '519 patent, claims 1 and 2 of the '942 patent, and claim 10 of the '233 patent against all Appellees. American Radio additionally asserted claim 3 of the '942 patent against Broadcom and Cisco, claim 10 of the '754 patent against Qualcomm and Intel, and claim 29 of the '334 patent against Qualcomm.[5]

Each asserted claim is directed to an apparatus or method for receiving an analog RF signal, digitizing that signal, and then (in most asserted claims) "reconstructing" the digital form of the signal. As an example, claim 3 of the '942 patent reads:

3. A receiver, comprising:

[5] American Radio incorrectly states that claim 3 of the '942 patent is asserted against Intel and Qualcomm. *See* AR Br. 29; A1094-101; A2129-35; A3218-25; A4301-10.

> a ***reconstruction*** circuit receiving an ***analog rf signal*** and generating a ***reconstructed*** waveform having substantially no distortions therein, wherein the reconstruction circuit includes:
>
> an analog to digital converter (ADC) for receiving the ***analog rf signal*** that has not been downconverted in the analog domain and outputting a ***digitized rf signal*** in response; and
>
> a module electrically connected to the ADC for receiving the ***digitized [rf] signal*** and in response outputting the ***reconstructed*** waveform in accordance with a predetermined ***reconstruction*** paradigm.

A180(8:51-63).[6]

D. The District Court's Claim Constructions

The district court issued a consolidated order in the underlying cases construing four different groups of terms from the asserted claims. A1-34.

1. "Analog signal" terms

Claim Terms	District Court Construction
"analog rf signal" "rf signal" "analog sinusoidal signal" "electromagnetic signal"	"the [analog rf/rf/analog sinusoidal/electromagnetic] waveform at the carrier frequency" (A7)

Each asserted claim uses one of the "analog signal" terms to describe a received signal that is digitized and reconstructed. The parties agreed that this signal is a "waveform," but they disputed whether the waveform must be at the carrier frequency (Appellees) or whether the waveform may first be "mixed" to a lower frequency (American Radio).

[6] Claim 3 contains a typographical error in which it refers to "the digitized if signal" rather than "the digitized rf signal." *See* AR Br. 30 n. 10; A5356.

The district court considered the "analog signal" terms as phrased in the claims—"analog rf signal," "rf signal," "analog sinusoidal signal," and "electromagnetic signal"—as opposed to construing the word "signal" in isolation, and it determined that each term means the relevant waveform at the carrier frequency. A7; A17-18. First, after "comb[ing] through the specification," the court concluded that the "analog signal" terms refer to the received RF signal, which is at the carrier frequency, and that the other terms were used in the same context as "rf signal." A8-9; A17-18. Second, the court explained that the specification informs a person of ordinary skill in the art that "***[t]he present invention*** is directed to removing distortions from rf signals ***prior to mixing***." A11 (quoting A158(4:15-17)). Third, the court reasoned that "[t]he import of … the specification is clear – after the signal is mixed, it is no longer the 'rf signal,' but is instead the IF signal." A14. Fourth, the court observed that the specification only refers to "mixing" a signal ***after*** it has been digitized and reconstructed and that "[mixing] the signals corresponding to the analog signal terms ***before*** reconstruction would frustrate the purpose of the invention." A7; *see also* A19-21. Finally, the court recognized that the specification's use of the "analog signal" terms as referring to a waveform at the carrier frequency was consistent with the ordinary meaning of "RF signal,"[7] as reflected in both intrinsic evidence (prior art

[7] Relatedly, the district court found that the terms "analog rf signal," "analog

cited during prosecution of the asserted patents) and extrinsic evidence (uncited prior art and technical dictionary definitions). A13-17.

2. "Digitized signal" terms

Claim Terms	District Court Construction
"digitized rf signal" "digitized signal representing the rf signal" "digitized signal in response" "digitized signal representative of the amplified signal" "digitized signal"	"the digitized form of the received [rf/analog sinusoidal/amplified electromagnetic] signals" (A23)

Each asserted claim uses one of the "digitized signal" terms to denote the signal that is generated by the analog-to-digital converter ("ADC") in response to receiving the "analog rf signal" (or equivalent term). The parties disputed whether this digitized signal is simply the digital form of the received RF signal, i.e., at the carrier frequency (Appellees), or whether it may be any "digitized waveform" (American Radio).

The district court construed the "digitized signal" terms to mean the digital form of the received signal. A23. As the court noted, the specification explains that an ADC is "[a] structure well-known in the art that outputs a digitized rf signal in response to the analog rf input from the antenna." A23 (quoting A158(4:42-45)). The court further observed that the specification nowhere suggests that either

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sinusoidal signal," and "electromagnetic signal" represent the same underlying signal as the term "rf signal." A17-19.

the ADC itself, or any circuit that processes the signal before it reaches the ADC, changes the signal's frequency in any way. A23. The court accordingly concluded that the "digitized signal" terms "are the digital forms of the analog signal terms which … are limited to signals at a frequency value equal to the carrier frequency." A23.

3. "IF"

Claim Term	District Court Construction
"IF"	"A frequency to which the input signal is shifted, including shifting the signal to zero Hertz" (A26)

Several asserted claims include the negative limitation that an input signal "has ***not*** been downconverted in the analog domain to IF." *E.g.*, A190(8:37-38). The parties agreed that "IF" stands for "intermediate frequency" and refers to a frequency to which an RF signal is shifted. A157(1:15-16); A728. The parties disputed, however, whether the term "IF" includes any frequency to which an RF signal is shifted, including zero Hertz (Appellees), or whether it is limited to a signal in a superheterodyne receiver that is shifted to a frequency greater than zero Hertz (American Radio).

The district court concluded that "IF" refers to any frequency to which a received signal is shifted, including a shift to zero Hertz. A24-26. The court determined that the intrinsic evidence demonstrates that persons of ordinary skill in

the art regularly use the term "IF" to refer to zero-Hertz signals, and that the specification provides no reason to depart from this ordinary meaning. A25-26.

4. "Reconstruction" terms

Claim Terms	District Court Construction
"reconstruction" "reconstructed" "reconstructing" "generating [a/the] reconstructed waveform"	"replacing a distorted portion of the input waveform at the carrier frequency with an undistorted portion, wherein the operand of the reconstruction operation represents one full wave or cycle" (A33)

The parties agreed below that the term "reconstruction" and its variants have no plain meaning in the art. A27. But the parties disputed whether the term should be construed based on the patent's description of "reconstruction" (Appellees), or whether it means "error reduction" generally (American Radio).

The district court determined that, because the "reconstruction" terms lack any particular meaning in the art, they should be construed based on the patentee's use of the terms in the specification. A27. The court then extracted the "common *modus operandi*" among all "reconstruction" techniques disclosed in the specification: (i) "replacing a distorted portion of the waveform … with an undistorted portion" (A27), and (ii) doing so by means of a cycle-by-cycle analysis in which the "operand of the reconstruction operation"—that is, what it operates on at each stage—"represents one full wave or cycle" (A31). The court did not, however, limit the "reconstruction" terms to any particular embodiment of

identifying the distorted portions of the input waveform or any particular source of the replacement waveforms. A31-32.[8]

The district court also ruled that "reconstruction" does not encompass Forward Error Correction ("FEC") (A30), an issue the court addressed because American Radio contended that the accused products satisfy the "reconstruction" limitations by performing FEC. *See, e.g.*, A6263(35:20-22). As the district court observed, FEC does not replace distorted portions of a waveform with undistorted portions. A30-31. Rather, FEC attempts to address errors in transmitted data by interpreting extracted information ***after*** mixing and demodulation. A29-31; *see also* A6215-17. Additionally, the court noted that, while "reconstruction … is performed ***one full wave*** at a time," FEC operates on multiple bits "representing not just one full wave but also ***neighboring redundant copies of the full wave***." A31 (emphasis in original). Thus, the district court concluded that FEC is "a type of error correction that falls entirely outside the scope of the teachings of the asserted patents." A30-31.

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[8] American Radio incorrectly claims that the district court's construction applied a "heightened level of precision" because it determined that the term "distortion" did not have the same meaning as "corruption," "noise," and "error." *See* AR Br. 37-38 (citing A27). In fact, the court merely found that the terms, while related, "[we]re not coextensive." A27. As this Court has recognized, even terms that are synonymous in some ways may have different scope. *See, e.g.*, *Int'l Rectifier Corp. v. IXYS Corp.*, 361 F.3d 1363, 1374 (Fed. Cir. 2004) ("[A]doption of a definition attributed to … a synonym of the claim term, disregards entirely the distinction between the two terms.").

E. American Radio's Stipulation Of Non-Infringement

American Radio stipulated that Appellees do not infringe the asserted claims under the district court's constructions and that each of the court's constructions provides an independent reason for a non-infringement judgment in favor of each Appellee. A1177-91. American Radio also stipulated that Appellees do not infringe because the district court's construction of "reconstruction" excludes Forward Error Correction. A1179-80.

Based on American Radio's stipulation, the district court entered final judgments of non-infringement in favor of all four Appellees. A35-38; A73-76; A111-14; A149-52. These appeals followed.

SUMMARY OF ARGUMENT

The "Analog Signal" Terms: The district court properly construed the entirety of the disputed "analog signal" terms, rather than just the word "signal" in isolation. It correctly construed the terms, based on the claims and specification, to refer to signals at the carrier frequency. The asserted claims recite receiving an "analog RF signal" (or similar) and then digitizing that signal, after which the signal may be reconstructed to replace distorted portions. As every disclosed embodiment shows, digitizing and reconstructing the signal occurs "prior to mixing"—i.e., before reducing the signal from the carrier frequency to a lower frequency. In fact, the specification criticizes mixing before addressing signal

distortion, because the mixing function causes data to be lost. The specification never uses the "analog signal" terms to refer to a waveform that has been downconverted to another frequency; once an RF signal is mixed, the specification refers to it instead as an "IF" signal. The district court's construction is further supported by intrinsic and extrinsic technical references demonstrating that persons of ordinary skill in the art refer to the carrier-frequency waveform as an "RF signal," and to the waveform produced by mixing as an "IF signal."

The "Digitized Signal" Terms: The district court correctly construed the "digitized signal" terms to mean the digitized form of the received analog signals. The claim language, the specification, and the plain meaning of the "digitized signal" terms all support this straightforward interpretation. American Radio's contention that the "digitized signal" terms may refer to ***any*** digitized waveforms contradicts both the claim language and the specification, which consistently show that the "digitized signals" have the same frequencies as their "analog signal" counterparts.

"IF": The parties agree that "IF" stands for "intermediate frequency." The district court properly construed "IF" to mean any frequency to which the received signal is shifted, including a frequency of zero Hertz. The specification explains that when a carrier-frequency signal (e.g., an RF signal) is mixed to a lower frequency as an intermediate step in the reception process, the resulting signal is an

intermediate frequency, or "IF," signal. American Radio argues that "IF" should not include signals at zero Hertz, and should further be limited to signals in a superheterodyne receiver. Both those contentions, however, are contradicted by intrinsic and extrinsic evidence demonstrating that persons of ordinary skill in the art have long used "IF" to refer to signals at zero Hertz and to signals in non-superheterodyne receivers. Further, contrary to American Radio's contention, the "invention" is not a "direct downconversion" receiver in which the received signal is downconverted directly from the carrier frequency to zero Hertz in a single step. AR Br. 67. In fact, direct conversion is not disclosed anywhere in the specification. Thus, the district court properly rejected American Radio's arguments and construed "IF" to mean a frequency to which the input signal is shifted, including shifting the signal to zero Hertz.

The "Reconstruction" Terms: The parties agreed below that the term "reconstruction" has no ordinary meaning in the art. It is therefore construed "only as broadly as provided for by the patent itself." *Irdeto Access, Inc. v. Echostar Satellite Corp.*, 383 F.3d 1295, 1300 (Fed. Cir. 2004). Here, the patentee used the term "reconstruction" to describe its purportedly new method of addressing signal distortion by replacing distorted portions of a waveform with undistorted portions. The specification is clear ***what*** "reconstruction" applies to—the input waveform at the carrier frequency—and ***how*** it operates—by replacing distorted parts of the

input radio signal with undistorted ones, one cycle at a time. The district court's construction properly reflects the "reconstruction" terms' usage in the claims and specification.

American Radio stipulated that Appellees do not infringe any of the asserted patents under the district court's claim constructions. The non-infringement judgments should accordingly be affirmed.

ARGUMENT

I. THE DISTRICT COURT CORRECTLY CONSTRUED THE "ANALOG SIGNAL" TERMS.

Each asserted claim uses the term "analog rf signal," "rf signal," "analog sinusoidal signal," or "electromagnetic signal" to describe a signal that is received and then digitized. While the parties agree that the word "signal," standing alone, means "waveform" (AR Br. 45),[9] the "analog signal" terms describe particular types of waveforms. The parties dispute whether the waveforms must be at the carrier frequency, or whether they may first be downconverted or "mixed" to a lower frequency. Based on their clear meaning within the context of the claims and specification, the district court correctly concluded that the "analog signal" terms each refer to a waveform at the carrier frequency. A7.

[9] Contrary to American Radio's claim (AR Br. 42-43), Appellees do not contend, nor did the district court hold, that the word "signal" itself is limited to any specific frequency.

A. The Claims And Specification Make Clear That The "Analog Signal" Is At The Carrier Frequency.

The asserted claims describe particular signal-processing sequences that begin with the receipt of an analog RF signal. The "analog signal" terms refer to the RF signal that was transmitted to the receiver, i.e., the waveform at the carrier frequency (A5; *see* AR Br. 8-10). *E.g.*, A157-58(1:20-22, 4:3-19) ("rf signal"); A157-58(2:16-19, 3:16-18) ("electromagnetic signal"); A158(4:3-19) ("analog sinusoidal signal"). Each signal represented by an "analog signal" term is then digitized, without any prior downconversion to a lower frequency. The digitized signal may then be "reconstructed," mixed, and demodulated.

Claim 10 of the '754 patent exemplifies this process:

> 10. An rf receiver, comprising:
>
> an antenna;
>
> a reconstruction circuit electrically connected to the antenna for ***receiving an analog rf signal from the antenna*** and generating a reconstructed waveform having substantially no distortions therein, wherein the reconstruction circuit includes:
>
> an analog to digital converter (ADC) electrically connected to the antenna for ***receiving the analog rf signal therefrom and outputting a digitized rf signal*** in response;
>
> a digital processor electrically connected to the ADC for ***receiving the digitized rf signal and in response outputting the reconstructed waveform*** in accordance with a predetermined reconstruction paradigm.

A161(9:63-10:11). This language makes clear that the analog signal received at the antenna is the same analog signal that is digitized and that the digital form of

that analog signal is then reconstructed. That the same signal is received, digitized, and reconstructed means that the carrier frequency of that signal has not changed. There has been no downconversion to a different frequency. While there are variations in the claim language, each asserted claim similarly recites (at least) receiving and digitizing an analog RF signal without any downconversion to a lower frequency. A171(10:8-15) ('233 patent, claim 10); A190(8:37-64) ('519 patent, claims 1-3); A180(8:37-62) ('942 patent, claims 1-3); A204(12:1-16) ('334 patent, claim 29).

Consistent with the claim language, the specification further demonstrates that the "analog signal" terms refer to the signal at the carrier frequency by uniformly describing the "invention" as digitizing and reconstructing the received analog RF signal before any mixing or demodulation. *See, e.g., C.R. Bard, Inc. v. U.S. Surgical Corp.*, 388 F.3d 858, 864 (Fed. Cir. 2004) ("Statements that describe the invention as a whole, rather than statements that describe only preferred embodiments, are more likely to support a limiting definition of a claim term."); *see also In re Abbott Diabetes Care Inc.*, 696 F.3d 1142, 1149 (Fed. Cir. 2012); *ICU Med., Inc. v. Alaris Med. Sys., Inc.*, 558 F.3d 1368, 1375 (Fed. Cir. 2009); *Alloc, Inc. v. ITC*, 342 F.3d 1361, 1368-70 (Fed. Cir. 2003).

To begin, the specification describes the analog RF signal of "the present invention" as the signal that is transmitted over the air, which is by definition at the

carrier frequency (A4; *see* AR Br. 8-10). A157(1:21-23) ("Of importance to the present invention is the fact that ***rf signals*** are corrupted by environmental factors ***during transmission***."); *see also* A158(4:6-11) ("As schematically shown in FIG. 1, ***the rf signal 12*** is an analog, sinusoidally shaped signal that is relatively smooth and undistorted when ***transmitted***, but which can become degraded and distorted as it propagates in the direction of the arrow 16 toward an rf antenna 18."). The Abstract similarly states that the analog RF signal is received from an antenna, which again refers to the signal that was transmitted over the air. A153 ("A waveform reconstruction circuit ***receives an rf signal from an antenna***, digitizes it, and then generates an undistorted reconstructed waveform.").

The specification explains that the analog RF signal is then digitized and reconstructed before it is mixed to a lower frequency. The specification clearly states that "***the present invention*** is directed to removing distortions from rf signals, ***prior to mixing*** and demodulating the signals." A158(4:15-17); *see also* A157(2:1-3) ("[I]t is an object of the present invention to provide a system and method for reconstructing a radio signal ***prior to mixing*** and demodulating the signal."). Figures 1 and 2 of the specification, which describe the "system" and "method" of the "invention," respectively (A158(3:60-64)), likewise show that the received analog RF signal is digitized at the carrier frequency:

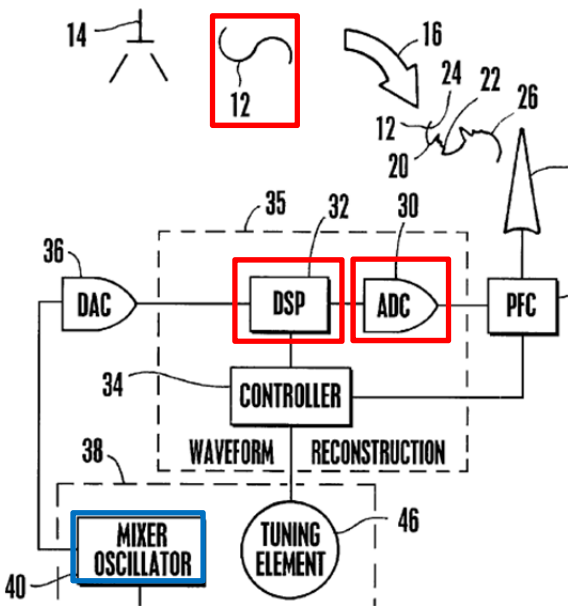

Fig. 1 (excerpt)

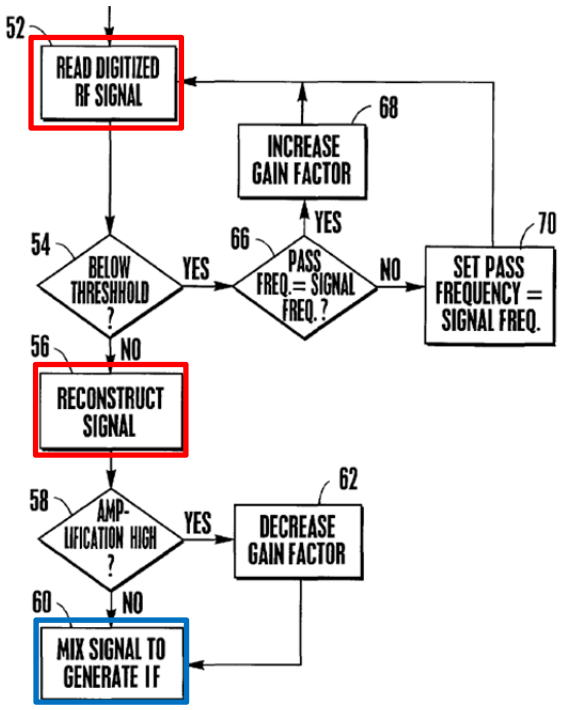

Fig. 2 (excerpt)

A154-55. The received analog RF signal 12 is digitized and reconstructed (red annotations) ***before*** any mixing to a lower frequency occurs (blue annotations). *See* A158(4:29-30, 4:40-51) (describing Figure 1); A159(6:35-47) (describing Figure 2).

The specification, moreover, criticizes systems in which the analog signal is downconverted from the carrier frequency to a lower frequency before addressing distortions, and it explains ***why*** the invention is directed to analyzing the signal prior to mixing: "the mixing function causes certain data in the signal to be irrecoverable and therefore precludes identification of some distortion and corruption in the 'true' signal post-mixing." A157(1:60-63). Thus, ***every*** figure and embodiment in the specification expressly includes reconstruction ***before***

mixing and demodulation. A154-58(2:17-46, 3:6-39, Figs. 1 & 2). *See, e.g.*, *Abbott*, 696 F.3d at 1149; *Alloc*, 342 F.3d at 1369-70.

Finally, the specification draws a clear distinction between RF signals (which are at the carrier frequency) and IF signals (which are at a different, intermediate frequency). The specification never uses the "analog signal" terms to refer to a signal that has been "mixed" from the carrier frequency to another frequency; to the contrary, it explains that mixing an RF signal to another frequency transforms the RF signal into an IF signal. A157(1:55-58) ("As further recognized by the present invention, it would be advantageous to accomplish such analysis prior to the non-linear transformation of the rf signal to the IF signal during mixing by the oscillator."). The specification consistently and repeatedly describes the mixer as receiving an RF signal as input and generating an IF signal as output. A157-59(2:17-34, 3:11-15, 5:11-15, 5:30-36, 6:44-47). Likewise, in discussing the prior art, the specification explains that conventional radio receivers "***receiv[e] an rf signal***" and that mixer oscillators in a conventional superheterodyne structure "mix[] ***the received signal*** down to an intermediate frequency (IF) signal." A157(1:12-17); *see also* A157(1:19-23). These sections of the specification further demonstrate that the "analog signal" terms refer to the signal at the carrier frequency, and not to a reduced frequency signal to which the receiver converts the received signal.

B. The District Court's Construction Is Consistent With The Plain And Ordinary Meaning Of "RF Signal."

The district court's construction is further supported by intrinsic and extrinsic evidence demonstrating that the ordinary meaning of "RF signal" is a signal at the carrier frequency.

Prior art cited on the face of the asserted patents shows that the ordinary meaning of "RF signal" is the signal received through radio transmission and that mixing the signal transforms it from an RF signal to an IF signal. *See, e.g.*, A559 (Schweber) ("[A] basic superhet receiver takes an amplified RF signal, mixes down to an IF using a local oscillator, then demodulates (decodes) the fixed-frequency IF signal."); A569-70 (Fletcher) (receiving the "wideband RF input" and mixing to an intermediate frequency signal). These references provide further intrinsic support for construing "RF signal" to mean a waveform at the carrier frequency. *See Powell v. Home Depot USA Inc.*, 663 F.3d 1221, 1231 (Fed. Cir. 2011) (prior art cited in a patent is intrinsic evidence for claim construction).

Additional prior art references confirm this meaning. For example, the Banu reference expressly labels signals prior to mixing as "RF" signals, and signals after mixing as "IF" signals (mixing circuits indicated in red):

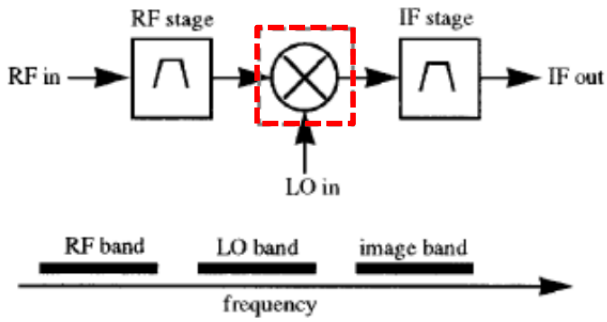

Fig.1 Superheterodyne down-converter

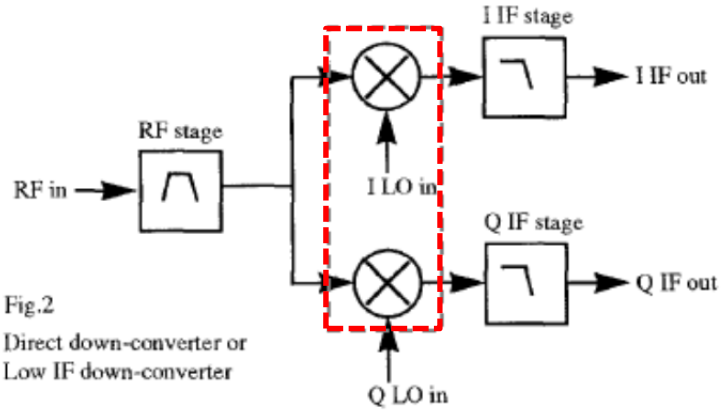

Fig.2
Direct down-converter or
Low IF down-converter

A591-92(Figs. 1-2); *see also* A597 (Schacherbauer, Fig. 2); A573 (Lawton) ("In a conventional radio architecture mixers and oscillators are used to perform frequency conversion to ultimately extract the information available on the RF (radio frequency) carrier."); A578 (Abidi, Fig. 4) (using "RF" to refer to the signal transmitted over the air and "IF" to refer to the signal after mixing in the receiver).[10]

[10] While these references are not cited in the asserted patents, they still "may assist in ascertaining the meaning of a term to a person skilled in the art." *Arthur A. Collins, Inc. v. Northern Telecom Ltd.*, 216 F.3d 1042, 1044-45 (Fed. Cir. 2000); *see also Nazomi Comm'ns, Inc. v. Arm Holdings, PLC*, 403 F.3d 1364, 1369 (Fed. Cir. 2005) ("[T]he prior art is often a reliable source of the understanding of one of ordinary skill in the art.").

C. American Radio's Contrary Arguments Lack Merit.

American Radio's contrary arguments have no support in the patents-in-suit; rather, they attempt to expand the scope of the claims beyond the claim language and specification and should be rejected.

1. The word "signal" should not be construed in isolation outside of the claims and specification.

American Radio attempts to reframe the dispute by suggesting that only the "signal" portion of the claim terms should be construed rather than the complete "analog signal" terms. *See* AR Br. 43-48.[11] Such an approach would be legally improper. As this Court has held, a multi-word claim term should not be construed word-by-word if that fails to capture the meaning of the whole phrase. *See, e.g.*, *Network Commerce, Inc. v. Microsoft Corp.*, 422 F.3d 1353, 1360 (Fed. Cir. 2005) ("Network Commerce … agrees that a definition of the term 'download component' as a whole does not exist, but invites the court to combine individual dictionary definitions of 'download' and 'component.' …. This is not a tenable theory in light of the specification.").

[11] American Radio argues that the claims, specification, and prosecution history do not narrow the ordinary meaning of "signal," which is not limited to a waveform at the carrier frequency. *See* AR Br. 43-48. These arguments are irrelevant, as there is no dispute that "signal," in isolation, means "waveform." Indeed, although American Radio notes that "the term 'signal' is used over 100 times in the specification" (AR Br. 44), it ignores that in each of those instances the word "signal" is preceded by a modifier that informs the meaning of the whole phrase, and that the specification consistently uses the "analog signal" terms to refer to signals at the carrier frequency.

Applying American Radio's fragmented approach here would result in constructions divorced from both the intrinsic and extrinsic evidence. In signal processing, just as in many other contexts, the plain meaning of a multi-word term is often more than the sum of its parts. Here, the complete "analog signal" terms convey a meaning to persons of ordinary skill in the art that is distinct from the separate meanings of the individual words, and thus should be construed as complete phrases. *See supra* Sections I.A, I.B.

American Radio also argues that the "analog signal" terms should be assigned an abstract "ordinary meaning" without reference to the claims or the specification. *See* AR Br. 43-45. American Radio even asserts that the specification need not be consulted, except "to see if the term ha[s] been redefined." AR Br. 44. As this Court held in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc), however, "the ordinary and customary meaning … is the meaning a term would have to a person of ordinary skill in the art ***after reviewing the intrinsic record at the time of the invention***." *Id.* at 1312-13. Thus, courts "cannot look at the ordinary meaning of the term … in a vacuum. Rather [they] must look at the ordinary meaning in the context of the written description and the prosecution history." *Id.* at 1313 (citation omitted); *see also Nystrom v. TREX Co.*, 424 F.3d 1136, 1144-45 (Fed. Cir. 2005). Indeed, the specification is "the single best guide to the meaning of a disputed term." *Phillips*, 415 F.3d at

1315. American Radio's argument that the "analog signal" terms should be construed without reference to the intrinsic evidence should be rejected.

2. American Radio's contention that the "analog signal" terms are not limited to signals "prior to mixing" is incorrect.

American Radio raises several arguments in support of its contention that the "analog signal" terms are not limited to signals at the carrier frequency. AR Br. 49-52. None has merit.

First, American Radio criticizes the district court's construction because it includes the term "carrier frequency," which American Radio argues is not used in the specification. AR Br. 49-50.[12] But, as American Radio acknowledges in the technical background section of its opening brief, the carrier frequency is the frequency at which a signal is transmitted across a communications channel. *See* AR Br. 8-10. The district court's construction captures the fact that the "analog signal" terms refer to a signal that has been received by a receiver, but has not yet been mixed to another frequency or demodulated. As discussed in Sections I.A and I.B above, this construction is compelled by both the claim language and the specification, and it reflects the terms' well-understood meaning in the art.

[12] Contrary to American Radio's suggestion, there is no requirement that a claim term be construed using language taken directly from the specification. *See, e.g.*, *Abbott Labs. v. Sandoz, Inc.*, 544 F.3d 1341, 1360 (Fed. Cir. 2008) ("[C]laim construction often calls upon words other than those of the patent, lest the claim simply define itself.").

Second, American Radio asserts that, except for certain explicit limitations, the claims otherwise permit a signal at the carrier frequency to be transformed into a signal at another frequency. AR Br. 50 & n.14. American Radio appears to be arguing that specific prohibitions in certain claims, e.g., that a signal "has not been downconverted in the analog domain to IF" (A190(8:37-46)), imply that the signal may be downconverted to some other form. *See* AR Br. 50 & n.14. Not so. As set forth in the "IF" section below, the specification and additional intrinsic and extrinsic references demonstrate that mixing an RF signal to another frequency transforms it into an IF signal, and thus a signal that "has not been downconverted to IF" is a signal at the carrier frequency.[13] *See infra* Section III.A. Furthermore, American Radio's claim interpretation is plainly contradicted by the specification, which emphasizes that the "invention" is directed to digitizing RF signals prior to mixing and demodulation so that "reconstruction" can be performed on the "true" signal. A157(1:51-63, 2:1-3); *see also supra* Section I.A.

Third, American Radio contends that "the specification as a whole shows that the term 'signal' as used by the claims is not limited to any particular

[13] The only other claim American Radio discusses with respect to this argument is claim 29 of the '334 patent, which recites a signal "which has not been downconverted after amplification." AR Br. 50; A204(12:7-10). As the specification makes clear, however, the received signal is not downconverted prior to amplification. *E.g.*, A158(3:40-47). Thus, a signal that "has not been downconverted after amplification" also is at the carrier frequency.

waveform or any particular location." AR Br. 51. However, the very passage American Radio relies upon—when read in conjunction with the preceding sentence omitted from American Radio's brief (*see* AR Br. 50)—directly contradicts American Radio's assertion:

> ***The present invention is directed to*** removing distortions from rf signals, ***prior to mixing and demodulating the signals*** incident to the decoding of useful information therefrom, thereby improving the fidelity and sensitivity of radio receivers.
>
> While the disclosure herein focuses on rf waveform reconstruction, it is to be understood that ***the principles of the present invention apply equally to other forms of modulated electromagnetic waves*** that are modulated as appropriate for the data the waves represent. For example, the principles of the present invention can be applied to processing modulated light waves that are transmitted through fiber optic bundles incident to the transfer of computer, video, or voice data.

A158(4:15-28). The first paragraph above makes clear that "the present invention" is directed to reconstruction prior to mixing and demodulating the received signal. The second paragraph states that these principles—including reconstruction prior to mixing and demodulation—may apply to other types of modulated electromagnetic signals, including modulated light waves. That the specification asserts that the described invention can be performed on signals in the visible spectrum as well as those in the RF range does not alter the description of "the present invention" as reconstruction prior to mixing and demodulation.[14]

[14] Relatedly, American Radio asserts that this passage of the specification supports its construction because "[m]odulated light waves are not necessarily

Moreover, the district court's constructions expressly allow for the "other forms of modulated electromagnetic waves" that American Radio references. For example, the term "electromagnetic signal" is construed to cover electromagnetic waveforms of any type. A18; A22. The court's construction reflects that the "analog signal" terms are all used to refer to the signal at the carrier frequency. A17-19; A22.

Fourth, American Radio argues that the district court improperly relied on language in the specification limiting the "analog signal" terms to signals at the carrier frequency. AR Br. 51-52. As described in Section I.A above, the patentee repeatedly stated that the "invention" concerned signals "prior to mixing" and that "it is an object of the present invention to provide a system and method for reconstructing a radio signal prior to mixing and demodulating the signal." *E.g.*, A157-58(1:55-58, 2:1-3, 3:61-64, 4:15-19). American Radio argues that these statements should not be read as limiting the scope of the invention to signals at the carrier frequency because the specification describes additional objects of the invention and because, in one instance, it refers to "the present invention" without the "prior to mixing" language. AR Br. 52.

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propagated at the carrier frequency." AR Br. 50. That contention is nonsensical—as American Radio elsewhere acknowledges, "carrier frequency" refers to the frequency at which a signal is propagated through a communications channel. *See* AR Br. 8-10.

But high-level, generalized descriptions of the invention do not negate specific descriptions demonstrating that the patentee circumscribed the invention. *See, e.g.*, *Alloc*, 342 F.3d at 1370 ("[T]his court looks to whether the specification refers to a limitation only as a part of less than all possible embodiments or whether the specification read as a whole suggests that the very character of the invention requires the limitation be a part of every embodiment."); *see also Asyst Techs., Inc. v. Emtrak, Inc.*, 402 F.3d 1188, 1194 (Fed. Cir. 2005) (rejecting construction that was "in tension with one of the objectives of the [invention]"); *Praxair, Inc. v. ATMI, Inc.*, 543 F.3d 1306, 1324 (Fed. Cir. 2008) (same).

As the district court recognized, mixing the "analog signal" prior to digitization would frustrate the very purpose of the invention because "the mixing function causes certain data in the signal to be irrecoverable and therefore precludes identification of some distortion and corruption in the 'true' signal post-mixing." A157(1:60-63); *see also* A19-20. No statement in the specification, and none of the objects of the alleged invention, conflicts with the stated object that the received RF signal is digitized prior to any mixing or demodulation.

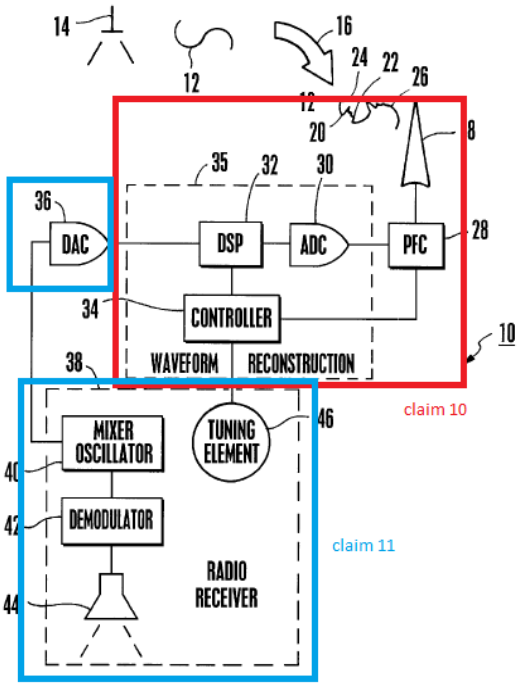
3. Claim differentiation does not support American Radio's construction.

Finally, American Radio asserts that, by limiting the "analog signal" terms to signals at the carrier frequency, the district court's construction violates the doctrine of claim differentiation. AR Br. 52-54. In particular, American Radio

contends that the only difference between claims 10 and 11 of the '754 patent is that claim 11 is limited to analog RF signals at the carrier frequency and that the district court's construction therefore "collapses the difference" between the claims. AR Br. 54. That argument is incorrect.

The two claims cover different subject matter. Claim 10 recites circuitry that generates a reconstructed signal (an antenna and a reconstruction circuit), while claim 11 recites additional circuitry that later processes the reconstructed signal (a digital-to-analog converter, a mixer, and a demodulator). These different components are shown in Figure 1 below:

<table>
<tr>
<td>Claim 10 (elements in red): An rf receiver, comprising:
o an antenna;
o a reconstruction circuit electrically connected to the antenna for receiving an analog rf signal from the antenna and generating a reconstructed waveform having substantially no distortions therein,
o wherein the reconstruction circuit includes:
o an analog to digital converter (ADC) …
o a digital processor ….

Claim 11 (elements in blue): The receiver of claim 10, further comprising:
o a mixer circuit electrically associated with the reconstruction circuit for generating an intermediate frequency (IF) signal based on the reconstructed waveform;
o a demodulator …; and
o a digital to analog converter (DAC) for converting the reconstructed waveform to an analog reconstructed waveform, prior to sending the reconstructed waveform to the mixer circuit.</td>
<td> 
</td>
</tr>
</table>

A154(Fig. 1); A161(9:63-10:21).

Under the district court's construction, as in Figure 1, the incoming "analog rf signal" at the carrier frequency is received, digitized, and reconstructed (claim 10), and the reconstructed signal may then be converted from digital to analog, mixed, and demodulated (claim 11). The differences between these claims are not "collapsed" under the district court's construction, and therefore the doctrine of claim differentiation is not applicable. *See, e.g.*, *Andersen Corp. v. Fiber Composites, LLC*, 474 F.3d 1361, 1370 (Fed. Cir. 2007) ("A further reason for not applying the doctrine of claim differentiation in this case is that the Group I claims are not otherwise identical …. Instead, there are numerous other differences varying the scope of the claimed subject matter.").

II. THE DISTRICT COURT CORRECTLY CONSTRUED THE "DIGITIZED SIGNAL" TERMS.

A. The "Digitized Signal" Terms Refer To The Digitized Form Of The Received Signal.

As with the "analog signal" terms, the parties' dispute with respect to the "digitized signal" terms concerns a single issue: whether the signals are the digitized forms of the received analog signals, as the district court concluded, or whether the terms can be ***any*** digitized signal in a receiver, regardless of frequency, as claimed by American Radio.[15]

[15] The "digitized signal" terms are "digitized rf signal," "digitized signal representing the rf signal," "digitized signal in response," "digitized signal

The claims and specification make clear that the recited "digitized signal" is the digital form of the received analog signal. In each asserted claim, an "analog signal" (or similar) is transmitted to a receiving device, where it is converted by an analog-to-digital converter into a "digitized signal." The "digitized signal" may then be reconstructed. As before, claim 10 of the '754 patent exemplifies this process:

> 10. An rf receiver, comprising:
>
> an antenna;
>
> a reconstruction circuit electrically connected to the antenna ***for receiving an analog rf signal*** from the antenna and generating a reconstructed waveform having substantially no distortions therein, wherein the reconstruction circuit includes:
>
> an analog to digital converter (ADC) electrically connected to the antenna for ***receiving the analog rf signal therefrom and outputting a digitized rf signal*** in response;
>
> a digital processor electrically connected to the ADC for ***receiving the digitized rf signal and in response outputting the reconstructed waveform*** in accordance with a predetermined reconstruction paradigm.

A161(9:63-10:11); *see also* A171(10:8-15) ('233 patent, claim 10); A190(8:37-64) ('519 patent, claims 1-3); A180(8:38-63) ('942 patent, claims 1-3); A204(12:1-17) ('334 patent, claim 29).

As discussed above, the "analog signal" input to the ADC is the signal at the carrier frequency. *See supra* Section I. The ADC simply converts that analog

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representative of the amplified signal," and "digitized signal." One of the "digitized signal" terms appears in each of the asserted claims. A34.

signal into digital form. *See* A153(abstract) ("A waveform reconstruction circuit ***receives an rf signal from an antenna, digitizes it***, and then generates an undistorted reconstructed waveform."); A157(2:16-19) ("An electromagnetic waveform reconstruction device includes an analog to digital converter (ADC) that is electrically connectable to an antenna for ***receiving an analog electromagnetic signal therefrom and digitizing the signal***."); A158(4:42-45) (ADC "outputs a ***digitized rf signal in response to the analog rf input from the antenna***").

Nothing in the specification indicates that the ADC shifts the frequency of the "analog signal" as part of the digitization process. To the contrary, it states that "[t]he ADC is [a] structure well-known in the art that outputs a digitized rf signal in response to the analog rf input from the antenna." A158(4:42-45). Nor does any other component reduce the frequency of the signal before digitization. A23. Thus, the district court properly concluded that the "digitized signal" terms refer to the digitized form of the received analog signal. A23-24.

B. American Radio's Contrary Arguments Lack Merit.

American Radio asserts that the district court's construction of the "digitized signal" terms is incorrect for two reasons. Neither has merit.

First, American Radio argues that the "digitized signal" terms should not be limited to the "digitized forms of the ***received carrier*** waveform" because there is "nothing in the claims that precludes an incoming carrier signal from being

transformed into another form before it is digitized." AR Br. 54 (emphasis in original). But as discussed above, the claim language, as well as the specification and additional intrinsic and extrinsic evidence, demonstrate that the claimed invention is directed to analyzing and reconstructing the digital form of the received analog signal, which is not mixed prior to digitization. *See, e.g.*, A157-58(1:51-63, 2:16-19, 4:42-45); *see also supra* Sections I.A, II.A. Under American Radio's proposed construction, the "digitized signals" would not be limited to the digital forms of the received analog signals as described in the claims and specification, but would encompass digital signals at any frequency. Because American Radio's proposed construction for the "digitized signal" terms is divorced from the intrinsic evidence, it should be rejected. *See Nystrom*, 424 F.3d at 1144-45.

Second, American Radio argues that the claims do not limit the "digitized" signal to the "received" signal, but instead specify which precursor signal the "digitized" signal represents (e.g., an "amplified signal" or an "rf signal that has not been downconverted in the analog domain to IF"). AR Br. 54-55. As the district court recognized, that misses the point—the issue is not whether some other operations (such as amplification or filtering) may be performed on a signal after it is received and before it is digitized by the ADC, but whether the signal may be mixed to a different frequency prior to digitization. *See* A23-24. As set

forth in Section I.A above, the claims and specification consistently demonstrate that the signal being digitized is the signal at the carrier frequency.

III. THE DISTRICT COURT CORRECTLY CONSTRUED "IF."

The parties agree that the term "IF" refers to a frequency to which a signal is shifted in a receiving device. AR Br. 65-67.[16] American Radio, however, contends that the term excludes signals at zero Hertz and that the term is further limited to signals in a superheterodyne receiver. The term "IF" appears only in negative limitations—for example, claiming a signal that "has ***not*** been downconverted in the analog domain to IF" (A190(8:37-38))—and thus the effect of American Radio's proposed construction would be to broaden the claims to encompass a signal downconverted directly to zero Hertz (i.e., "direct conversion"). The specification, however, does not disclose "direct conversion"—there is no embodiment in which a signal is downconverted from the carrier frequency to zero Hertz in a single step. The district court properly rejected American Radio's arguments and construed the term to mean "a frequency to which the input signal is shifted, including shifting the signal to zero Hertz." A34.

[16] "IF" appears in the following asserted claims: '233 patent, claim 10; '942 patent, claims 1 and 2; and '519 patent, claim 1. A171(10:8-15); A180(8:37-50); A190(8:37-46).

A. The District Court Properly Construed "IF" To Have Its Plain And Ordinary Meaning.

"IF" is an abbreviation for "intermediate frequency." This term is well-understood in the art to mean a frequency to which a transmitted signal is shifted in a receiver. *See, e.g.*, A555 (IEEE Dictionary). The specification consistently uses the term "IF" in accordance with this plain and ordinary meaning, describing mixer circuits that shift the frequency of an input signal to produce an IF signal. *See, e.g.*, A158(3:12-16) ("***A mixer circuit*** is electrically associated with the signal reconstruction circuit for ***generating an intermediate frequency (IF) signal*** based on the reconstructed waveform, and a demodulator decodes useful information from the IF signal."); A159(5:12-16) ("[T]he DAC 36 is electrically connected to an oscillator mixer 40 of the radio receiver 38, and ***the mixer 40 outputs an intermediate frequency (IF) signal*** in accordance with principles well-known in the art, based upon the analog signal from the DAC 36."); A159(6:45-47) ("[T]he logic proceeds to block 60, wherein the reconstructed signal is ***mixed … to generate an IF signal***."); A155(Fig. 2, block 60) ("Mix signal to generate IF.").

Furthermore, both intrinsic and extrinsic sources demonstrate that the term "IF" encompasses signals shifted to zero Hertz. For example, U.S. Patent No. 4,733,403 ("Simone")—which is cited on the face of the '942 patent (A172), and therefore constitutes intrinsic evidence for purposes of claim construction, *see*

Powell, 663 F.3d at 1231—expressly teaches that zero Hertz can be an intermediate frequency:

> This invention relates generally to intermediate frequency circuits and more particularly to digital intermediate frequency circuits where ***the intermediate frequency is zero Hertz***.

A624(1:5-8); *see also* A624(1:20-22) ("[A]ny receiver with ***an intermediate frequency of zero Hertz*** is referred to as a direct conversion receiver.").

Extrinsic references similarly show that the ordinary meaning of "intermediate frequency" includes zero Hertz. U.S. Patent No. 4,709,402 ("Akerberg"), for example, describes a "receiver … of the homodyne type, i.e., its ***intermediate frequency is zero Hz***." A616(5:64-65). The Lawton reference teaches that "[f]or zero IF ***the intermediate frequency*** $f_{IF} = 0$." A575. And the Wilson reference explains that "the ***IF*** center frequency ***is the lowest possible (zero)***." A601.

American Radio nonetheless contends that the district court's construction "removes the concept of 'intermediate' from 'intermediate frequency.'" AR Br. 68. That is incorrect. An "intermediate frequency," as the dictionary cited by American Radio itself explains, is "[a] frequency to which a signal wave is shifted locally as an intermediate ***step*** in transmission or reception." AR Br. 67 (citing A778-79). Any IF signal, including an IF signal at zero Hertz, is generated as an

intermediate step in the reception process to facilitate subsequent steps in which the information carried by the signal is extracted. *See supra* Fact Section B.

B. American Radio Improperly Seeks To Limit "IF" To Superheterodyne Receivers.

American Radio also contends that the term "IF" refers only to signals in "superheterodyne receivers."[17] AR Br. 65. "Superheterodyne" receivers downconvert analog signals in two or more stages before digitization, in contrast to "homodyne" (or "direct conversion") receivers, which downconvert analog signals only once—directly to zero Hertz—before digitization. *See* A24; *supra* Fact Section B. Because the term "IF" appears in negative limitations (e.g., "receiving as input an rf signal that has ***not*** been downconverted … to IF" (A171(10:9-10))), American Radio's proposed construction would broaden the claims to encompass direct conversion receivers. That construction was properly rejected because it is inconsistent with the plain meaning of "IF," contrary to every embodiment in the specification, and in conflict with the stated purposes of the invention.

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[17] In its *Markman* briefs, American Radio argued that "IF" should be construed to mean "a frequency to which a signal is shifted as an intermediate step ***in*** a superheterodyne receiver." A728. At the *Markman* hearing, it proposed a "modified" construction: "a frequency to which a signal is shifted as an intermediate step ***such as*** the frequency shift that occurs in a superheterodyne receiver." A6325(97:16-18). American Radio purports to assert its "modified" construction on appeal, but its brief makes clear that there is no actual distinction between the two proposed constructions. *See* AR Br. 65-66, 68.

First, a person of ordinary skill in the art at the time of the claimed invention would not understand "IF" to be limited to superheterodyne receivers. As noted above, numerous technical publications and patents (including an intrinsic reference) confirm that other types of receivers (including direct conversion receivers) produce "IF" signals as well. *See*, *e.g.*, A624(1:5-8); A616(5:64-65); A601; A575; A592; *see also supra* Section III.A.

Second, direct conversion prior to digitization is not disclosed anywhere in the specification. In every embodiment, the received RF signal is digitized and then "reconstructed" at the carrier frequency. *See supra* Section I.A. After the digitized signal is reconstructed, it may then be mixed to an "IF" signal as Figures 1 and 2 of the specification show:

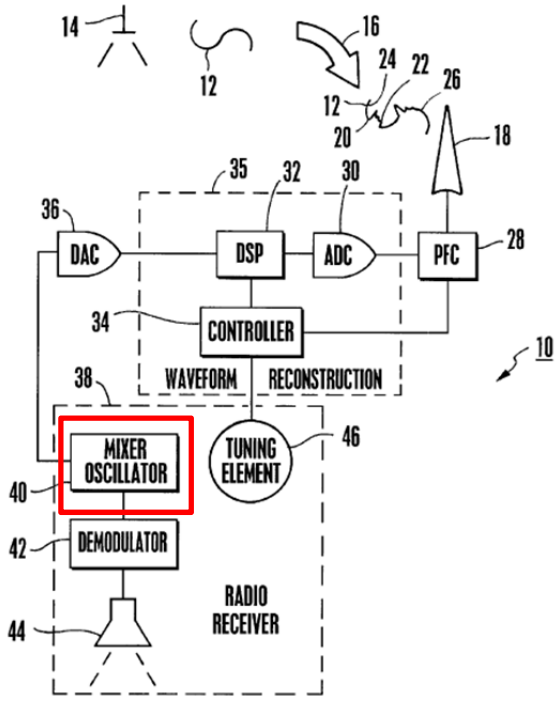

Fig 1.

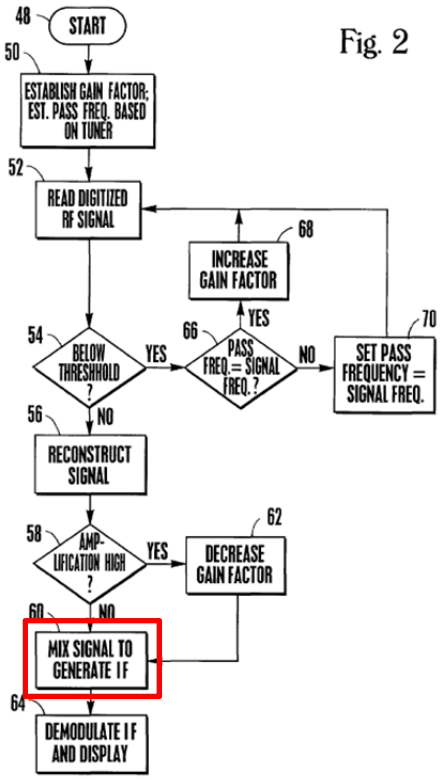

Fig. 2

A154-55; *see also* A159(5:7-16, 6:44-47, 54-56) (describing reconstruction followed by mixing). By contrast, a direct conversion receiver would mix the received RF signal to a zero-Hertz IF signal ***before digitization***. A6219. Thus, far from being the patented "invention," as American Radio contends (AR Br. 67), direct downconversion to zero Hertz prior to digitization is not even disclosed in the asserted patents and is contrary to the purpose of the invention.[18]

[18] American Radio conceded at the *Markman* hearing that direct downconversion to zero Hertz does not appear in the body of the specification, but it contended (incorrectly) that it was disclosed by the claims containing a "has not been downconverted to IF" limitation. A6322-23(94:12-95:18). The earliest asserted patent to feature such a claim limitation is the '233 patent, which was not filed until December 10, 2007. A163; A171(10:9-10).

Finally, American Radio mischaracterizes the specification's discussion of "conventional superheterodyne structures." *See* AR Br. 66-67 (citing A157(1:12-20)). The specification does not criticize prior art superheterodyne receivers because they downconvert a received signal in two or more stages. Rather, it criticizes those structures because they mix the signal ***at all*** before analyzing it for distortions and because they use conventional techniques for addressing signal distortion rather than the claimed "reconstruction" method. *See* A157(1:12-67); *see also infra* Section IV.

In short, American Radio's proposed construction of "IF" would rewrite the claims to support its reinterpretation of the patents as "direct downconversion inventions" (AR Br. 67), which contradicts ***every*** disclosed embodiment. That cannot be correct. The district court's construction should be affirmed.

IV. THE DISTRICT COURT CORRECTLY CONSTRUED THE "RECONSTRUCTION" TERMS.

As American Radio conceded below, the term "reconstruction" has no plain meaning in the art.[19] A733 ("[T]he term 'reconstruction' is not commonly used by

[19] The "reconstruction" terms include "reconstruction," "reconstructed," "reconstructing," and "generating [a/the] reconstructed waveform." Additionally, American Radio concedes that the district court's construction of the "reconstruction" terms also applies to the "replacement" terms that the parties addressed separately in their *Markman* briefs. AR Br. 4 n.2, 32. At least one of the "reconstruction" or "replacement" terms appears in each asserted claim, except for claim 10 of the '233 patent and claim 1 of the '942 patent. *See* A161(9:63-10:11); A190(8:37-64); A180(8:47-63); A204(12:1-17).

persons of skill in the art.").[20] As such, "reconstruction" should be construed "only as broadly as provided for by the patent itself." *Irdeto*, 383 F.3d at 1300; *see also J.T. Eaton & Co. v. Atl. Paste & Glue Co.*, 106 F.3d 1563, 1570 (Fed. Cir. 1997). When the patent does not provide a precise definition in "explicit definitional format," this Court looks to whether "the specification … define[s the] claim terms by implication." *Irdeto*, 383 F.3d at 1300. An implicit definition may be found where "every example in the specification … consistently" includes the same feature. *Id.* at 1301 (limiting term with no ordinary meaning to a common feature of the examples in the specification); *see also Abbott*, 696 F.3d at 1150 (same); *Honeywell Int'l Inc. v. Universal Avionics Sys. Corp.*, 488 F.3d 982, 991 (Fed. Cir. 2007) (construing coined term based on its use in the specification); *MyMail, Ltd. v. Am. Online, Inc.*, 476 F.3d 1372, 1376 (Fed. Cir. 2007) (same).

The specification describes "reconstruction" as a purportedly new technique for addressing waveform distortion that is performed on the waveform before mixing and demodulation. A157(2:1-3); *see also* A157(2:1-13) (every "object of the present invention" involves "reconstructing a radio signal"). Based on the

[20] "Reconstruction" is used in the art, if at all, to describe a variety of disparate signal processing techniques that are unrelated to the "reconstruction" described in the specification. These include: converting a waveform from analog form to digital form and back (A643; A653; A661); representing signal values as vectors (A680); separating multiplexed signals (A699); and creating a time domain signal from optical techniques (A704).

teachings of the specification, the district court correctly construed the "reconstruction" operation to have two aspects: ***what*** it operates upon ("the input waveform at the carrier frequency"), and ***how*** it operates (by "replacing a distorted portion of the input waveform … with an undistorted portion, wherein the operand of the reconstruction operation represents one full wave or cycle."). A26-33.

A. The Specification Teaches That "Reconstruction" Operates On The Input Waveform At The Carrier Frequency.

The specification confirms the district court's determination of ***what*** reconstruction operates upon—namely, "the input waveform at the carrier frequency." A34. It teaches that reconstruction is performed on the incoming radio signal (e.g., "rf signal"). Indeed, the patents are titled "System and Method for ***Radio Signal Reconstruction*** ...." A153; *see also* A154(Fig. 1). And the specification repeatedly describes "reconstruction" of ***the RF signal*** before mixing and demodulation as a key feature and object of the patented invention:

> "[I]t is an object of the present ***invention*** to provide a system and method for ***reconstructing a radio signal prior to mixing and demodulating*** the signal." A157(2:1-3).
>
> Figure 1, which shows "the system of the present ***invention***," A158(3:60-61), is described as "a system … for ***reconstructing an rf waveform signal*** 12 that has been transmitted by an rf transmitter." A158(4:3-6).
>
> "The present invention is directed to ***removing distortions from rf signals,*** prior to mixing and demodulating the signals." A158(4:15-17).

See also supra Section I.A. The specification reinforces this point by criticizing prior-art receivers that destroy useful information by mixing and demodulating the received RF signal before analyzing distortions. A157(1:20-63); *cf. Chicago Bd. Options Exch., Inc. v. Int'l Secs. Exch., LLC*, 677 F.3d 1361, 1372 (Fed. Cir. 2012) (disparaging prior art can lead to a narrow construction). The specification thus makes clear that "reconstruction" operates upon the input waveform at the carrier frequency, before mixing and demodulation.

B. The Specification Teaches That "Reconstruction" Involves Replacing Distorted Waveform Portions One Cycle At A Time.

The district court also correctly identified ***how*** "reconstruction" operates: by replacing distorted portions of the input radio signal with undistorted ones, one cycle at a time.

The specification describes "reconstruction" in Figures 2 and 3 and the accompanying text. *See* A159(5:56-58) ("FIGS. 2 and 3 represent logic flow charts of the present reconstruction means for implementing the predetermined reconstruction paradigm of the present invention."). In every embodiment, the "reconstruction" operation analyzes the input waveform ***one cycle at a time***. *See* A160(7:38-42) ("[I]t is determined whether the complete waveform cycle (i.e., one positive half-cycle and its negative half-cycle) has been analyzed. If it has been, the process proceeds to block 82, to analyze the next cycle …"); A159(6:28-30) ("[P]ositive and negative half cycles of a digitized waveform having distorted and

undistorted portions are received [for reconstruction] from the ADC."); A156(Fig. 3) ("reconstruction" flowchart showing (element 82) that analysis of the next cycle begins when analysis of current cycle ends).

If distortions are found, the specification describes three ways of repairing them. Each one expressly requires ***replacing*** a distorted portion of the waveform with an undistorted portion. In one method, "the distorted portion is ***replaced*** with the inverse of the corresponding waveform portion." A160(7:36-37). In another, "distorted portions of waveforms are ***replaced*** by smooth portions … in accordance with F[ast] F[ourier] T[ransform] principles." A160(7:57-60). And in the third, "distorted portions of the input waveform [are] ***replaced*** by smooth portions … using so-called wavelet analysis." A160(7:62-64). Thus, the specification "repeatedly, consistently, and exclusively" uses the term "reconstruction" to refer to an operation in which distorted portions of a waveform are replaced with undistorted portions, one cycle at a time. *Irdeto*, 383 F.3d at 1300.[21] At the same time, it disparages prior-art receivers that used filtering—a method of addressing signal distortion that does not operate by replacing distorted waveform portions. A157(1:22-30).

[21] The specification also expressly identifies the "reconstructed" signal as the product of such replacement. A159(5:59-65) ("[T]he advantages of the present invention can be realized by … ***replacing*** each distorted portion with a respective replacement portion …. ***Thereby, a reconstructed rf signal is produced***.").

The district court was thus correct to conclude that "reconstruction" operates by "replacing a distorted portion of the input waveform … with an undistorted portion, wherein the operand of the reconstruction operation represents one full wave or cycle." A33; *see also Irdeto*, 383 F.3d at 1301 (in absence of customary meaning, construing a "group" of subscribers to cover only subsets of subscribers because "every example in the specification … consistently point[s] to an implicit definition of group as a subset of all subscribers"); *Goldenberg v. Cytogen, Inc.*, 373 F.3d 1158, 1165-66 (Fed. Cir. 2004) (absent customary meaning, requiring "intracellular marker substance" to be "wholly internal to the cell," in part because all "twenty-six example antigens provided in the … patent" had that feature); *Network Commerce*, 422 F.3d at 1360-61 (absent customary meaning, construing "download component" to require a "boot program" based on disclosed embodiments); *MyMail*, 476 F.3d at 1376 (absent customary meaning, construing terms to require feature common to all claimed embodiments).

American Radio argues that the district court's construction limits the claims to the preferred embodiments. AR Br. 59-63. But as set forth above, the court's construction reflects "reconstruction" as described to be the invention and used in ***every*** embodiment. *See Cordance Corp. v. Amazon.com, Inc.*, 658 F.3d 1330,

1340 (Fed. Cir. 2011).[22] It properly "tether[s] the claims to what the specification[] indicate[s] the inventor actually invented." *Retractable Techs., Inc. v. Becton, Dickinson & Co.*, 653 F.3d 1296, 1305 (Fed. Cir. 2011); *see also* A31-32 (explaining that the district court's construction of "reconstruction" does not limit the term to any specific method of identifying distorted portions of the input waveform, does not require a separate step of identifying distorted portions, and does not designate the source of the replacement/undistorted portions).[23]

American Radio also contends that the specification's boilerplate assertion that "the scope of the present invention fully encompasses other embodiments" expands the meaning of "reconstruction" beyond the specification. AR Br. 62 (quoting A160(8:19-23)). But "common boilerplate language that does not specifically address the inventive features in any detail" does not expand claim scope. *IP Innovation, LLC v. Ecollege.com*, 156 F. App'x 317, 321 (Fed. Cir. 2005) (non-precedential); *see also Wireless Agents LLC v. Sony Ericsson Mobile*

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[22] American Radio appears to concede that the disclosed methods of "reconstruction" involve replacing a distorted portion of an RF signal. *See* AR Br. 61-62.

[23] American Radio relies on *International Electronic Technology Corp. v. Hughes Aircraft Co.*, 2005 WL 6077046 (C.D. Cal. Sept. 21, 2005). AR Br. 61. In that case, the district court declined to limit the term "disabling event" because it was "unimportant to the [claimed invention] what the disabling event is." 2005 WL 6077046, at *4. In contrast, here, "reconstruction" is important to the claimed invention. *See Andersen*, 474 F.3d at 1367 (finding limitation was not a preferred embodiment, but instead an essential feature where consistent characterizations were directed to the invention as a whole).

Commc'ns AB, 189 F. App'x 965, 967 (Fed. Cir. 2006) (non-precedential). Furthermore, neither the "objects" of the alleged invention nor any description of the alleged invention suggest "reconstructing" a signal by any method other than what is described in the specification and reflected in the district court's construction.

C. American Radio's Proposed Construction Finds No Support In The Specification, Intrinsic Evidence, Or Extrinsic Evidence.

American Radio's proposed construction—"error reduction"—is unsupported. The specification never describes "reconstruction" as "error reduction." American Radio simply asserts that "distortion" is synonymous with "error" and rewrites sentences from the specification to replace references to "distortion" with references to "error reduction." *See* AR Br. 21, 58. The specification, however, explains that the purported invention is directed to replacing distorted portions of a received waveform with undistorted portions—not to all methods of addressing "distortion" in a signal. *See supra* Section IV.B.

Furthermore, "reconstruction" is a point of purported novelty. American Radio's proposed construction of "error reduction" would read this novelty out of the claims and would even encompass prior-art distortion-reduction methods, such as filtering, that the specification criticizes and distinguishes. *See* A157(1:23-28). That cannot be correct. "While it is true that not every advantage of the invention must appear in every claim, it would be peculiar for the claims to cover prior art

that suffers from precisely the same problems that the specification focuses on solving." *LizardTech, Inc. v. Earth Resource Mapping, Inc.*, 424 F.3d 1336, 1343-44 (Fed. Cir. 2005).

American Radio seeks to capture prior-art techniques that do not "reconstruct" an RF signal prior to mixing and demodulation, as the specification requires. In particular, it asserts that "reconstruction" encompasses processes—such as Forward Error Correction—that (a) are performed ***after*** mixing and demodulation, and (b) work on the ***underlying data***, rather than a modulated carrier waveform. That is plainly inconsistent with the specification, which does not discuss any operations performed after mixing and demodulation, or any operations performed on the underlying data. *See supra* Section IV.A. Indeed, the specification is clear that "reconstruction" is completed ***before*** the "useful information" is extracted. *See, e.g.*, A159(5:7-18) ("***After reconstructing*** the rf waveform, … [t]he IF output from the mixer 40 is then sent to a demodulator 42, which decodes the signal to extract useful information therefrom."); A155(Fig. 2) (showing "demodulate" step after completion of "reconstruction" step).

Similarly, American Radio's construction does not require that "reconstruction" be performed one wave or cycle at a time or operate by replacing a distorted portion of a waveform with an undistorted one. It contends that "reconstruction" covers methods—again including Forward Error Correction—that

instead interpret the underlying data carried on multiple cycles of a waveform. AR Br. 58-59. That, too, is unsupportable. *See supra* Section IV.B; *see also* A30-31 (discussing differences between "reconstruction" and Forward Error Correction, and explaining why the latter "falls entirely outside the scope of the teachings of the asserted patents").

D. American Radio's Other Arguments Are Meritless.

1. General purpose dictionary definitions and other references are irrelevant because "reconstruction" has no plain meaning, and they do not support American Radio's position in any event.

Even though "reconstruction" lacks a plain meaning in the art, American Radio argues that the term should nonetheless be construed in accordance with non-technical dictionary definitions. AR Br. 58-59. That is inconsistent with the law. "[W]here evidence … demonstrates that artisans … would attach no meaning at all to the claim term independent of the specification[,] general-usage dictionaries are rendered irrelevant with respect to that term." *Irdeto*, 383 F.3d at 1300 (citation omitted).

The dictionary definitions that American Radio cites do not support its position in any event. It identifies only two definitions of the term "reconstruction," both from *The New International Dictionary of the English Language Unabridged* (Vol. II 1993). AR Br. 58-59. The first—"action of reconstructing or state of being reconstructed" (A791)—is circular, and thus not

informative for claim construction. And the second—"something reassembled (as from parts) into its original form or appearance" (A791)—describes a different concept than the specification. The waveform in the specification is not described as disassembled into parts or "reassembled" from them. *See* A154-58(2:16-3:67, Figs. 1-3).

American Radio also contends that its proposed construction is supported by definitions of the terms "distortion," "error correction," and "error correction coding" from technical dictionaries. AR Br. 59. None of these dictionaries, however, defines "reconstruction" as "error reduction." *See* A784; A785; A777.[24] Moreover, these definitions actually support the district court's construction, as they reflect the distinction between distortions in a waveform and errors in underlying data. *Compare* A784 (defining "distortion" as "any undesired change ***in the waveform***"), *with* A777 (defining "error correction coding" as a method that enables decoding hardware "to reconstruct ***the original data***").

[24] The definitions of "distortion" and "error correction" do not use the word "reconstruction." A784; A785. Meanwhile, "error correction coding" is defined as "encoding of data and redundant check bits that enables decoding hardware to reconstruct the original data in the presence of a data-bit or check-bit error." A777. "Error correction coding" is not referenced or described in the patents. It is an operation performed on underlying transmitted data after extraction to correctly interpret the data as it existed before modulation—not "reconstruction" performed on a modulated RF signal waveform to replace distorted portions with undistorted portions before extracting the underlying information. A30-31.

Relatedly, American Radio argues that U.S. Patent No. 5,142,551 ("Borth") supports construing "reconstruction" to mean "error reduction." AR Br. 57. It does not. The passages American Radio cites do not even mention "reconstruction," let alone define it as "error reduction." *See id.* Nor do they prove that "the terms corruption, noise, distortion, and error [are] … synonymous," as American Radio contends. *Id.* To the contrary, Borth distinguishes between these "transmission errors" and "distortions," which result from noise, and "the erroneous interpretation of the information content of the actual[] transmitted signal," i.e., errors in the underlying data. A4782(3:61-66); A4784(7:21-26). Thus, Borth supports the distinction between distortions in a signal and errors in the underlying data.

Finally, even if these general purpose dictionaries and technical references supported American Radio's contention that the abstract meaning of "reconstruction" overlaps with the concept of "error reduction," they could not be used to overcome the specification's express teachings, which demonstrate that the patentee used the term "reconstruction" to refer to a process of replacing distorted portions of a waveform with undistorted portions, one wave or cycle at a time. *See Phillips*, 415 F.3d at 1320-22; *see also supra* Sections IV.A, IV.B.

2. The Donoho, Basseville, and Coifman articles do not support a broader construction of "reconstruction."

American Radio contends that the district court's construction excludes methods of "reconstruction" disclosed in three prior-art articles by Donoho, Basseville, and Coifman that the specification purports to incorporate by reference. AR Br. 62-63. In particular, American Radio contends that, while the district court's construction limits "reconstruction" to methods of replacing distorted portions of waveforms, the specification incorporates these articles in order to depict "reconstruction" methods that do ***not*** work by replacing distorted waveform portions. AR Br. 62-63.[25] But the specification says the opposite. It explains that these articles are incorporated to show wavelet-analysis methods that ***do*** work by replacement:

> ***In wavelet analysis, small undistorted waveform segments*** are stored in a library and are fitted to the undistorted portions of the input waveform as needed to ***replace distorted waveform portions. Examples of such analysis are disclosed by, e.g., Donoho … ; Basseville … ; and Coifman …***, all of which publications are incorporated herein by reference.

A160(7:64-8:11).

Moreover, America Radio provides no support for its conclusory assertion that the articles disclose any techniques that operate without replacing distorted

[25] American Radio does not argue that Donoho, Basseville, or Coifman discloses any form of Forward Error Correction or that Forward Error Correction is a form of "reconstruction." *See* AR Br. 24, 62-63.

waveform portions. *See* AR Br. 24, 62-63. Any such argument is therefore waived. *Ajinomoto Co. v. ITC*, 597 F.3d 1267, 1278 (Fed. Cir. 2010) ("[A] conclusory assertion [in an opening brief] unaccompanied by developed argumentation does not preserve the issue."); *SmithKline Beecham Corp. v. Apotex Corp.*, 439 F.3d 1312, 1320 (Fed. Cir. 2006) ("When a party includes no developed argumentation on a point … we treat the argument as waived under our well established rule." (citation omitted)).

Finally, even if American Radio had identified disclosures in these articles of a method of improving a signal other than replacing distorted portions of a waveform with undistorted portions, such material was not incorporated by reference. "To incorporate material by reference, the host document must identify with detailed particularity what specific material it incorporates and clearly indicate where that material is found in the various documents." *Advanced Display Sys. Inc. v. Kent State Univ.*, 212 F.3d 1272, 1282 (Fed. Cir. 2000); *see also SkinMedica, Inc. v. Histogen Inc.*, 727 F.3d 1187, 1207-08 (Fed. Cir. 2013) (holding that an allegedly incorporated document "does not inform [the claim construction] analysis" when the patent references it only generically, and not specifically "to define what [is] meant by [the disputed claim term]."). As noted above, the specification purports to incorporate the articles solely to illustrate "reconstruction" using wavelet analysis wherein "small undistorted waveform

segments are … [used] to ***replace*** distorted waveform portions." A160(7:61-8:11). Thus, the district court's construction is fully consistent with and supported by the specification's alleged incorporation of the Donoho, Basseville, and Coifman articles.

3. The doctrine of claim differentiation does not support American Radio.

Finally, American Radio argues that the district court's construction violates the doctrine of claim differentiation because it eliminates any differences between claims 3 and 4 of the '942 patent. AR Br. 63-64. The district court's construction, however, does not give these claims the same scope, and thus the doctrine of claim differentiation does not apply. *See, e.g.*, *Andersen*, 474 F.3d at 1370.

Claim 3 requires "outputting the reconstructed waveform in accordance with a predetermined reconstruction paradigm." A180(8:61-63). Claim 4 adds the limitation that "the paradigm includes replacing at least one distorted portion of the signal with a replacement portion ***that is based on at least some undistorted portions of the signal***." A180(8:64-67). The emphasized portion of claim 4 is not part of the district court's construction of "reconstruction," and thus claim 4 is narrower than claim 3. A33.[26]

[26] For example, some "reconstruction" methods may obtain replacement waveform portions from a library rather than from the signal itself, and thus satisfy claim 3 but not claim 4.

Moreover, even if claim differentiation were applicable, that doctrine cannot be used to expand the claims beyond their proper scope, as would result from adopting American Radio's overbroad construction. *See, e.g.*, *ICU Med.*, 558 F.3d at 1376; *Multiform Dessiccants, Inc. v. Medzam, Ltd.*, 133 F.3d 1473, 1480 (Fed. Cir. 1998).

CONCLUSION

The district court's judgments should be affirmed.

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Respectfully submitted,

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ECF-3(B)(2) REPRESENTATION

Pursuant to this Court's Administrative Order Regarding Electronic Case Filing, the undersigned represents under ECF-3(b)(2) that counsel for Qualcomm Incorporated, Cisco Systems, Inc., and Broadcom Corporation have consented to their signature on this brief.

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CERTIFICATE OF SERVICE

I hereby certify that I filed the foregoing Brief for Defendants-Appellees Qualcomm Incorporated, Cisco Systems, Inc., Intel Corporation, and Broadcom Corporation with the Clerk of the United States Court of Appeals for the Federal Circuit via the CM/ECF system this 24th day of February, 2014, and served a copy on counsel of record by the CM/ECF system and by electronic mail.

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CERTIFICATE OF COMPLIANCE

Pursuant to Fed. R. App. P. 32(a)(7)(C), the undersigned hereby certifies that this brief complies with the type-volume limitation of Fed. R. App. P. 32(a)(7)(B)(i).

1. Exclusive of the exempted portions of the brief, as provided in Fed. R. App. P. 32(a)(7)(B), the brief contains 13,374 words.

2. The brief has been prepared in proportionally spaced typeface using Microsoft Word 2010 in 14 point Times New Roman font. As permitted by Fed. R. App. P. 32(a)(7)(B), the undersigned has relied upon the word count feature of this word processing system in preparing this certificate.

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